

Long-term land cover change impacts on stream channel loss

Jason Julian, Nicholas Wilgruber, Kirsten de Beurs, Rana Jawaneh, Paul M. Mayer

Abstract

Land cover change and stream channel loss are two related global environmental changes that are expanding and intensifying. Here, we examine how different types and transitions of land cover change impact stream channel loss across a large urbanizing watershed with large areas of forest, grassland, and water. We present historical land cover in the 666-km² Lake Thunderbird watershed in central Oklahoma (USA) for five timestamps over a 137 year period and coinciding stream channel length changes for the most recent 70 years of this period. Combining these two datasets allowed us to assess the interaction of land cover changes with stream channel loss. Over this period, the upper third of the watershed shifted from predominantly native grassland to an agricultural landscape, followed by widespread urbanization. The lower two-thirds of the watershed changed from a forested landscape to a mosaic of agriculture, urban, forest, and open water. The largest losses to the stream channel network over this timeline were creation of two large impoundments, resulting in a combined loss of 71 km of stream channel. Most channel length lost in the watershed over time was replaced by agricultural land cover. Urban development and fragmentation gradually increased channel loss and disconnection, particularly in the headwaters in the upper part of the watershed. Overall, the results from this study demonstrate that multiple and various land-use changes over long time periods and large spaces can lead to rapid losses of large channel lengths as well as gradual losses of small channel lengths across all stream sizes. When these stream channel losses are taken into account, the environmental impacts of anthropogenic land-use change are compounded.